DOCUMENT RESUME

ED 220 043 HE 015 402

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TITLE	Student Persistence Patterns: A Computerized System for Monitoring Enrollment. AIR Forum 1982 Paper.
PUB DATE	May 82
NOTE	29p.; Paper presented at the Annual Forum of the Association for Institutional Research (22nd, Denver, CO, May 16-19, 1982).
EDRS PRICE	MF01/PC02 Plus Postage.
DESCRIPTORS	*Academic Persistence; College Students; *Computer Oriented Programs; Databases; Data Collection; Dropout Characteristics; Dropout Rate; *Enrollment Trends; Higher Education; *Information Systems; Institutional Research; Longitudinal Studies; Models; Student Attrition; *Student Characteristics; Student Records
IDENTIFIERS	*AIR Forum; Eastern Montana College; *Student Flow Model

ABSTRACT

The design and development of a computerized student flow model at Eastern Montana College and its use in monitoring student enrollment are considered. In addition, guidelines are presented for adapting a flow model to the dimensions of a particular institution. Particular emphasis is given to reviewing the criteria that researchers should use when evaluating student flow models for a possible application at their own institutions. The model is a computerized recordkeeping system that allows the monitoring of individual students and their progress through the college. The system, comprised of a series of COBOL programs, stores selected student characteristics and attendance patterns in the flow model master file. In addition to updating student records in the master file and adding new students each academic quarter, statistical and persistence records are generated. Student characteristics, such as age, sex, and high school grade point average, are stored in the master file, which can be accessed interactively to view or change individual records. Student persistence is reported both in individual and summary form for the students being monitored. Special reports for various types of students, such as older students or minority students, may be generated. The system utilizes three files: the student file, the graduation file, and the flow model master file. The following variables may be used either singly or in combination to select the specific group of students: class, status, quarter of attendance, major, ethnicity, and sex. The student profile report includes information on geographic origins, age distribution, and part-time and full-time status. (SW)

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STUDENT PERSISTENCE PATTERNS:

A COMPUTERIZED SYSTEM FOR MONITORING ENROLLMENT

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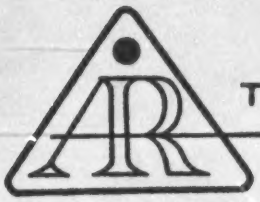
Presented at the Twenty-Second Annual Forum of the
Association for Institutional Research
Denver, Colorado
May 1982

HE 015 402



THE ASSOCIATION FOR INSTITUTIONAL RESEARCH

This paper was presented at the Twenty-Second Annual Forum of the Association for Institutional Research held at the Denver Hilton Hotel in Denver, Colorado, May 16-19, 1982. This paper was reviewed by the AIR Forum Publications Committee and was judged to be of high quality and of interest to others concerned with the research of higher education. It has therefore been selected to be included in the ERIC Collection of Forum papers.

D. R. Coleman, Chairman
Forum Publication
Advisory Committee

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ABSTRACT

This paper reviews the design, development, and use of a student flow model at an urban commuter college. The system allows examination and analysis of student persistence patterns on a regular, timely basis. Persistence reports--by student characteristics such as sex, part-time vs. full-time, ethnic status, major, age, GPA, or a combination of variables--are generated. In addition, students who have withdrawn are identified for follow-up purposes. Reports are given to offices and academic departments who have an interest in a particular group of students. The paper concludes with guidelines for tailoring a student-flow model to meet the dimensions of a particular institution.

In spite of a shrinking pool of 18 year-olds, enrollment on American college campuses reached an all-time high last fall. The National Center for Education Statistics reported an estimated 12,322,469 students were enrolled, up 1.9 percent over the Fall of 1980 (Magarrell, 1981). Although enrollment in higher education for the nation as a whole has never been higher than in 1981-82, some colleges and universities have already experienced declines, and most are bracing themselves for moderate to severe declines throughout the remainder of the 1980's. Enrollments are expected to drop sharply next year, warns the Chronicle, based on the fact that about half of both public and private colleges are reporting fewer freshman applications than at the same time last year (Magarrell, 1982).

Faced with a decreasing pool of traditional students, some institutions look towards improving student retention as one means of shoring up enrollment trail-offs anticipated in the decline in the 18-21 year-old cohort. As Lenning (1978), Pantages and Creedon (1979), and others have noted, up to one-third and more of the students at various colleges and universities drop out before graduation, leading to wastage, student disillusionment, and empty spaces. Each person lost means one more person that must be recruited to keep enrollment up. Thus, improving retention is a very attractive way of keeping enrollment up during a time when the traditional pool of applicants is decreasing.

Before a retention strategy with high potential for success can be developed, however, each institution must have a comprehensive understanding of its own attrition and a longitudinal data collection.

effort is a necessary prerequisite to such understanding. Analysis of the data can help an institution understand the dimensions of its attrition problem, help identify critical problem areas, as well as help identify areas in which opportunities for positive change may exist given the development of appropriate corrective measures (Naylor and Sanford, 1982, p. 143).

There are almost as many kinds of persistence patterns as there are individual students. Some students drop out during the first week never to return, some students are continuously enrolled every single quarter until graduation, while other "revolving door' students enroll for a few quarters, interupt their studies for awhile, and then return again at some later date (Cope, 1975). The task of following individual students, or a particular cohort, throughout an academic career is a formidable one. Lacking the development of a carefully designed and well thought-out system for monitoring enrollment, such a task may meet with difficulty and founder.

Purpose

This paper reviews the design and development of a computerized student flow model at one institution, Eastern Montana College, and its use in monitoring student enrollment patterns. In addition, guidelines are presented for adapting a flow model to the dimension of a particular institution. Particular emphasis is given to reviewing the criteria which researchers should use when evaluating student flow models for a possible application at their own institutions.

The development of a student flow model has provided this college with the capability of separating fact from fiction in looking at student enrollment patterns. Several myths have been dispelled, such as the commonly held assumption that minority students tend to withdraw more frequently than nonminority students. Reports generated by the flow model are provided on a quarterly basis to various support offices and academic departments, permitting the areas of the college most concerned with the progress of certain subgroups (such as minorities, liberal arts majors, or undecided students) to track such students over an extended period of time. Persistence reports are also provided to the campus retention committee, which is responsible for designing and monitoring efforts to improve retention. The system permits an early identification and follow-up of students who have ceased to be continuously enrolled. As an added feature, a quarterly student body profile with statistics for such items as headcount, FTE, geographic origins, and age, is generated.

Literature Review

The heightened interest on the part of colleges and universities in student retention is reflected in the burgeoning retention literature. For the reader interested in the general topic of retention, several comprehensive literature reviews exist (see, for example, Tinto, 1975; Sheman and Tinto, 1975; Pantages and Creedon, 1978; Lenning, Beal, and Sauer, 1980), and there are several excellent annotated bibliographies available (Jackley, 1980; Easton, 1980). Studies describing various programs and strategies to improve retention have been reported (Beal and Noel, 1979;

Sherman and Tinto, 1975; White and Bighorn, 1982; Astin, 1975; Reducing the dropout rate, 1979). The National Center for Higher Education Management Systems (NCHEMS) has developed a manual with procedures, questionnaires and materials to help postsecondary institutions conduct attrition studies (Patrick, Myers, and Van Dusen, 1979).

Of special interest to the present study are some recent conference papers describing student flow models. See, for example, Hartley and Fredrick (1978), Yancy (1981), and Tilton (1979). The model discussed in this paper has incorporated many aspects of these other previous models.

Of particular interest to the development of a flow model are studies which have identified the characteristics of students most clearly related to retention. These characteristics can be classified into two categories: pre-enrollment traits or pre-college traits, such as personal or family attributes. Other student characteristics can be termed post-enrollment variables, and they are in some sense assigned to an individual by the institution, such as grades, class standing, major and so on. Researchers have found both pre-enrollment traits and post-enrollment traits are useful in distinguishing persisters from nonpersisters.

Cope and Hannah (1975), for example, found that the characteristics of students most clearly related to retention had to do with their families, themselves, their educational experiences prior to entering college, and their attainment expectations. They found that one of the best predictors was family social economic

status, or SES, which is a combination of parental education, wealth, and expectations for their children's education. An even better measure of retention was the standard scholastic aptitude tests given to entering students, while the best measure of all was the student's high school grade point average (Cope, 1978).

The earlier work of Hackman and Dysinger (1970) found that commitment to college on the part of students and parents both was an important determinant of who remains in college and who withdraws. They found that parental attitudes and values about higher education were just as important in differentiating persisters from voluntary withdrawals as were the data provided by the students themselves. They concluded that a student's home and family are highly important in determining reaction to the college experiences. Students with better-educated parents were more committed to college. Students whose parents felt they had made the right decision in attending that particular college tended to be persisters.

Of special interest in designing a flow model is a referral to theoretical works which contribute to an understanding of the complex interactions of the underlying dynamics of student retention. Building on the theoretical framework developed by Spady (1970) and Tinto (1975), the most significant contributions to such an understanding have been those of Pascarella and Terenzini (1977, 1979, 1980), Pascarella, Duby, Miller and Tasher (1981), Terenzini and Pascarella (1977, 1978), and Aitken (1982).

According to Tinto (1975), students pre-college traits lead to varying levels of goal and institution commitment which, in turn,

interact with the academic and social environment of the institution, resulting in varying levels of integration in the institution's social and academic systems. Other things being equal, the higher the degree of integration of the individual into the college systems, the greater will be his commitment to the specific institution and to the goal of college completion (Tinto, 1975, p. 96). Terenzini and Pascarella attempted two replications of Tinto's theoretical model in an effort to operationalize and test the constructs of social and academic integration and institutional and goal commitment. They found that a 34-item, 5-factor "integration" measure had substantial predictive validity - 79% of the persisters and 76% of the voluntary leavers were correctly classified. The five factors or five integration scales were: peer group interactions; interactions with faculty; faculty concern for student development and teaching; academic and intellectual development; and institutional and goal commitment. The authors concluded that the five integration scales may be useful in identifying freshmen who are at some risk of dropping out, and could be used in an experimental retention program. One of their major findings was that the role of the model's institutional and goal commitment construct was central in predicting which students would persist and which would drop out. The two items with the highest loading on that factor were the following:

1. It is important for me to graduate from college.
2. I am confident that I made the right decision in choosing to attend <u>this</u> college.

Pascarella et al. (1981) in a recent study attempting to differentiate persisters, "stopouts", and early withdrawals reported findings suggesting that voluntary withdrawal is less a function of preenrollment traits than of postenrollment experiences. First-quarter grades were again the variable that permitted clear-cut discrimination between persisters and early withdrawals. Pascarella et al. found that preenrollment traits were successful in distinguishing stopouts, but not successful in distinguishing persisters and early withdrawals, without the addition of first-quarter grades.

Likewise Aitken, who developed a comprehensive theoretical model using multiple regression analysis, found that the first quarter GPA was the most significant variable in explaining freshman retention, defined as returning the second year. Also related to retention was degree of student satisfaction with residential living experience, academic satisfaction, and concern with family and personal problems.

Background

Eastern Montana College is a publicly-supported, four-year comprehensive state college, with some master's level programs. As an open-admissions, open-enrollment institution, the College draws most of its students from the middle band of high school students, with only about one-third of the new freshmen ranked in the upper 20% of their high school class. A very high percentage - 80% - of the students are first generation college students, with neither parent having completed college. Perhaps as a result of low family expectations, many of the students stop out and drop out. The

college has a severe attrition problem. Of the first-time freshmen in Fall 1980, less than half were still enrolled one year later. This compares with a national average retention rate after one year of 67% (Beal and Noel, 1979).

The students evidence all the characteristics of drop-out prone freshmen as described by Astin (1979): poor academic records in high school, low aspirations, poor study habits, relatively uneducated parents, and small-town or rural backgrounds. Most of the students are older, and most do not live in the residence halls, thus not having the advantage of experiencing the valuable and positive socialization that facilitates a student's adjustment and consequent satisfaction with the institution. In short, the college does not have a problem distinguishing freshmen persisters from nonpersisters. They are almost all at some risk of dropping out. Many of them lack a strong commitment or family tradition for completing a college degree, and most of them do not actively seek admission to Eastern Montana College because of its uniqueness. They come because the college is here.

A flow model was needed for two main reasons: 1. to be able to collect and report accurate statistics on the attrition problem; 2. to be able to provide timely information to offices and departments working directly with students on the progress of the students they are interested in.

Student Flow Model System Overview

The Student Flow Model is a computerized record-keeping system that allows the monitoring of individual students and their progress through the College. They system, comprised of a series of COBOL

programs, stores selected student characteristics and attendance patterns in the Flow Model Master File. In addition to updating student records in the Master File and adding new students each academic quarter, statistical and persistence reports are generated. Student characteristics, such as age, sex, and high school GPA, are stored in the Flow Model Master File, which can be accessed interactively to view or change individual records. Student persistence, that is, the extent to which students are continuously enrolled, is reported both in individual and summary form for the students being monitored. Special reports for various types of students, such as older students or minority students, may be generated. For reasons of confidentiality, individual names are suppressed as needed. The system programs are as follows:

1. Programs used to initiate the system:
   a. IR100 - Builds the first Master File.
   b. IR110 - Stores quarter of entry for all students.
2. Programs run each academic quarter:
   a. IR200 - Updates the Master File and generates the Student Profile Report.
   b. IR210 - Updates students not in attendance during the current quarter.
   c. IR220 - Persistence Report and Persistence Summary for all students.
   d. IR230 - Stores quarter and year of graduation.

3. Programs used as needed:

   a. IR400 - Interactive access to the Master File to view, add, change, or delete individual records.

   b. IR500 - Variable Criteria Selection - enables the user to specify the student characteristics to be included in the Persistence Report and Summary.

   c. IR600 - Builds two data files for statistical analysis, one file contains the students defined as persisters and the other nonpersisters.

   d. IR700 - A special group of programs to monitor the enrollment of students who utilize the Student Services Office (currently under development).

See Figure 1 for an overview of the Student Flow Model System and Figure 2 for the Optional programs.

System Files

The system utilizes three files, the Student File, the Graduation File, and the Flow Model Master File. The Student File, the primary source of information for the Flow Model, lists all students eligible to register for a given quarter, by class, number of credits, and personal information. By using this file, "owned" by the Registrar, the Institutional Research Office is not responsible for data entry. The Flow Model Master File stores the information from the Student File so that it is available for report and analysis at any point in time.

During the year, students who graduate are entered into the Graduation File by the Registrar's Office. This information is used

to mark the records in the Flow Model Master File to indicate what quarter and year students complete their degrees.

The Flow Model is an Indexed Sequential Access Method (ISAM) file which can be read sequentially or directly as appropriate. By identifying various student characteristics, a specific sub-group of students may be selected for tracking and statistical analysis. Each record contains that student's current class, status, quarter, year, and the credits for each quarter attended. In the unlikely situation that a student will enroll for more than 28 quarters, the information from the earliest quarters is deleted.

Programs Used

The initial step in beginning the Student Flow Model System was the development of a program to read the Fall 1980 Student File and create the first Master File. This program is run only once, and is then saved on tape for backup purposes. A second one-time-only program was written to retrieve quarter of entry from the Student Cumulative File for Students in attendance in Fall Quarter 1980, when the Flow Model was initiated.

Three programs are run each academic quarter, the Quarterly Update, the Update of Nonattendance, and the Persistence Report. In addition, two optional programs are available to be run as needed, the Interactive Access to the Master File, and the Variable Criteria Selection program.

The Quarterly Update Program (IR200) updates the Master File each quarter at the end of the third week of instruction. IR200 reads the current Student File, records student attendance, stores

any changes in personal information (such as a change in student identification number) and adds new students to the file.

The Graduation Update (IR230) reads the Graduation file and stores the quarter and year of graduation in the appropriate records. Should a student show up in the graduation file who is not in the Flow Model Master File, that student's name and information is written in the exception report, constituting another check on the system's validity.

One optional program, the Interactive Access program (IR400) is used to view, add, change, or delete individual records from the Master File. Another optional program, the Variable Criteria Selection program (IR500) allows the user to select a specific group of students that he or she is interested in monitoring. For example, the institutional research office may wish to compare the persistence patterns of freshmen who have declared a major with freshmen who are undecided. The Student Services area may wish to monitor progress of students enrolled in remedial programs. The format for the report generated by this program is the same as the one produced by the Persistence Report (IR220). (See Figure 1) The following variables may be used either singly or in combination to select the specific group of students.

1. class
2. status
3. quarter of attendance
4 major
5. ethnicity
6. sex

Should the user attempt to select a group of students that is beyond the capability of the system, an appropriate message is displayed on the screen and the program exits.

Since IR200 reads through all students as it updates the Master File each quarter, it is also used to generate a Student Profile Report. This report contains the following information:

1. Enrollment, headcount and FTE, graduate and undergraduate, part-time and full-time.
2. Number and percentages of men and women.
3. Number and percentages of minority students.
4. Geographic Origins.
5. Age Distribution.
6. Class Distribution.
7. Marital Status.

During the quarterly updating, occasionally a student record may be missing from the file. IR200 adds the record to the file and includes that record in the exception report. By checking the exception report, problems in the program can be identified. After each quarter's update by IR200, a nonattendance counter is incremented by 1 for those students who did not attend during the current quarter.

After the Master File has been updated, the Persistence Report (IR220) is generated. This report lists all students by student identification number, sex, ethnicity, entry quarter, GPA, and total credits accumulated. (See Figure 3 for an illustration of the output.) A summary page gives total by class for each quarter and

year beginning with Fall 1980 when the system was first initiated. (See Figure 4)

Guidelines for Developing a Student Flow Model

Researchers interested in developing a flow model for their own institutions, or in tailoring a model to their own specifications, should give consideration to the following points.

1. Purpose Must Be Clear. The purpose for which the flow model is to be developed must be clearly identified, understood, and agreed upon by all those involved in the project. Our experience has reinforced the wisdom in the axiom that the more sure you are ahead of time of where you are going, the better chance you have of getting there. In general, there are three kinds of models: one being a simple tracking system to be used primarily by an institutional research office to report regularly and routinely to the administration or to a retention committee on retention rates. A second model would be one designed primarily for research purposes where the data base is used to test hypotheses about retention. This model would also perform the function of the first, that is, it could be used to report retention rates. But considerable time must be spent in determining which variables to include, and also which variables are feasible to include. The third model is a hybrid of the first two, and is the kind of model described in this paper. As the flow model was being developed, it changed from a very simple project to a fairly complex system. Such "tailoring" is limited only by the resources, creativity, and expertise available.

2. Use Student Programmers. Large institutional research offices with their own programmers can simply assign someone to this

task. Others, however, who must utilize a centralized computer facility, may find that a student flow model does not rank high on the computer center's list of priorities. Students in advanced computer programming classes are often looking for a real project. Such an assignment can provide a good learning experience or independent study project for the student. One problem using students is they may not complete the project. This flow model took between 6-9 months to develop. We would suggest that the student programmer be assigned to work closely with a technical advisor on the computer center staff. Such involvement would guard against a potential lack of continuity for the project, prevent the student programmer from going off on an impracticable tangent, and help resolve problems that will arise about security and confidentiality of student records. If the flow model is to be kept current, it must become a part of the standard repertoire of both the computer center and the institutional research operations.

3. Communication. There must be ongoing dialogue between the user and the programmer, especially throughout the design stage. There are critical decision points all along the way that require frequent consultation between the user and the programmer, regarding such things as report formats, optional features, output design, and so on. We often found a great difficulty in explaining to one another just exactly what we wanted and how it was supposed to look.

4. Data Entry. To avoid costly data entry considerations, every effort should be made to access official college files that are created and maintained by another office, such as the Registrar. For the flow model described here, the Office of Institutional

Research had no responsibility for data entry and utilized other existing files entirely.

5. The Variable Criteria Selection report is, from the user's point of view, an elegant option. One sits down at the terminal and selects what will go into a report. However, from the programmer's point of view, this report involves extremely complex logic and is very costly in terms of the time needed to prepare it.

6. Review the Literature. If the main purpose of the flow model is research into the retention process itself, then one is advised to carefully review the literature for guidance in selecting student and institutional characteristics to include in the model. Practical considerations based on accessibility and availability of data will likely limit the variables finally included. For instance, in our case, it was not possible to include high school grade point average since it is not a part of the permanent student record. What we have done is to leave space in the file for possible future inclusion of variables like this.

7. A Final Note. Getting the flow model institutionalized is a big concern right now, since the student programmer has left and the technical adviser from the computer center has left. From our vantage point today, we would advise that the writing-up of the documentation for the computer programs go hand-in-hand with the development of the programs themselves. Procedures must be written up and in place so that there is a record of how the flow model works. In light of the high turnover of computer programmers, this caveat is important to mention.

Conclusions and Implications

This paper provided information on the development of a computerized student flow model designed to monitor and report student enrollment. Colleges and universities interested in improving student retention by means of a system which permits the accurate identification of student persistence patterns over many years, coupled with the reporting of such patterns on a timely basis to critical responsibility centers, will find this paper of practical application. Researchers interested in tailoring a student flow model to their own institutional requirements will find this paper helpful. Documentation for the computer programs utilized is available from the authors upon request.

Student Flow Model System

Quarterly Processing

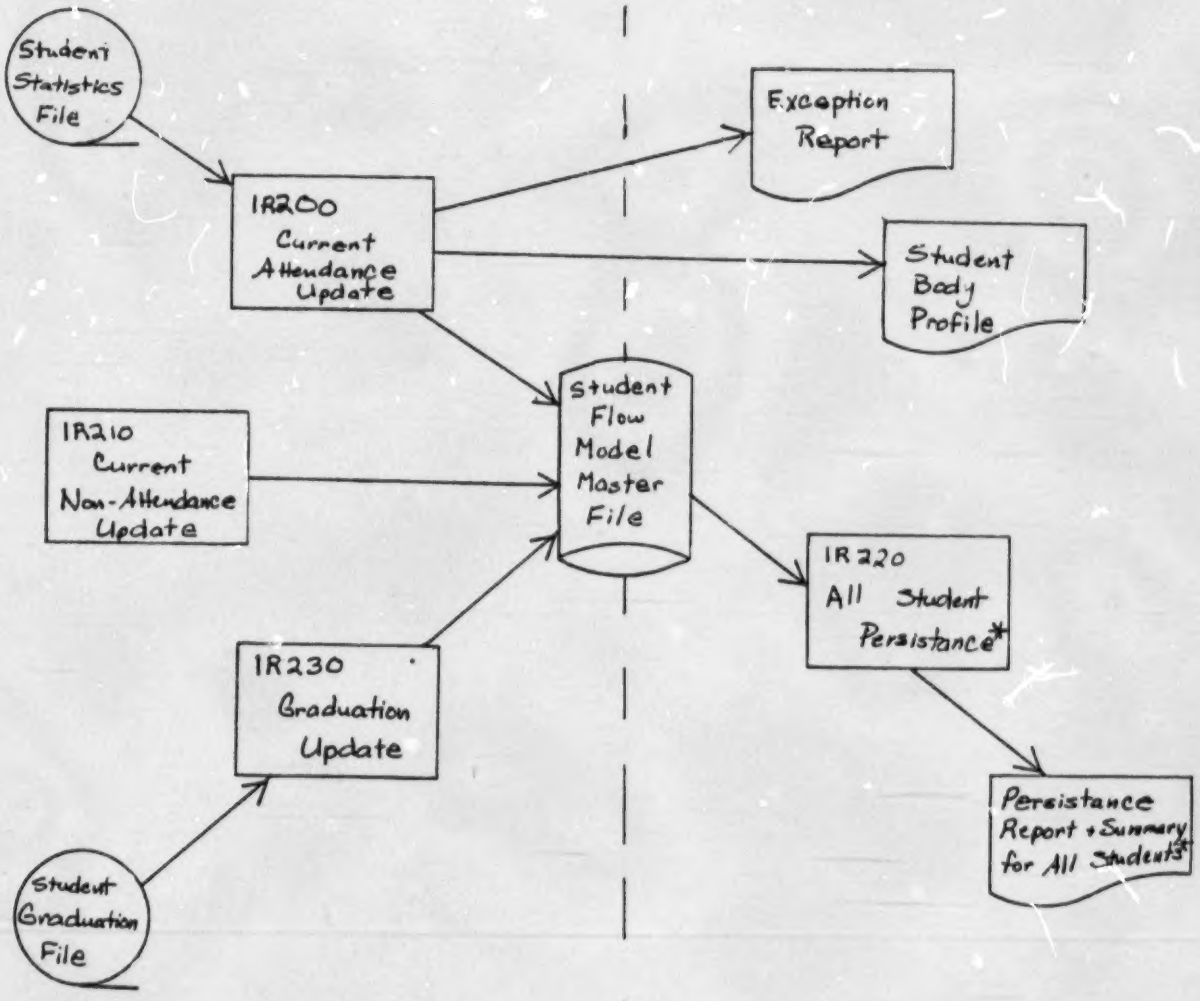

Figure 1: Overview of the Student Flow Model System.

* after 3 consecutive quarters of non-attendance, the student does not appear on this report

Student Flow Model System

Optional Programs

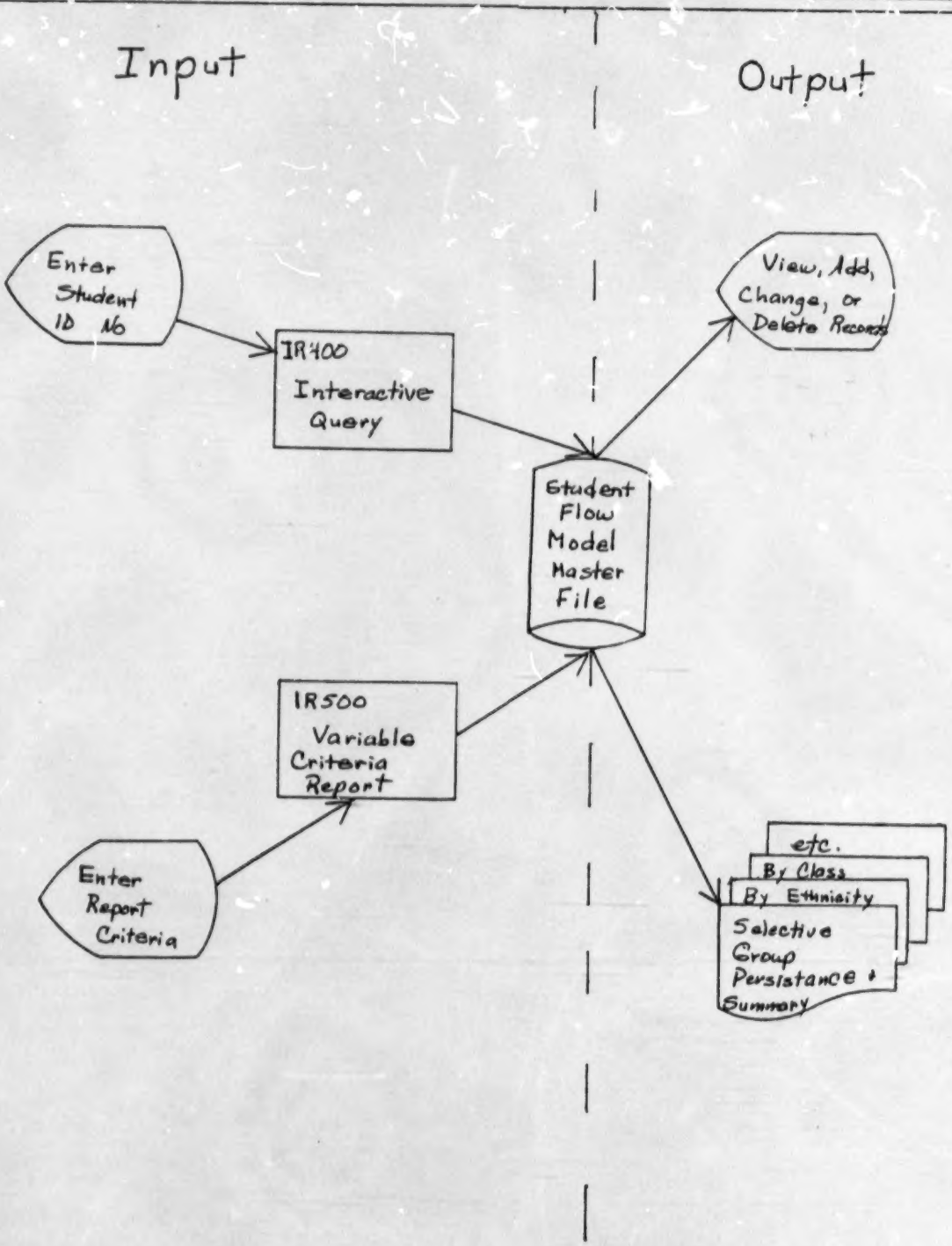

Figure 2: Optional Programs

01/02/82
OTHER FRESHMEN:

EASTERN MONTANA COLLEGE
STUDENT PERSISTENCE PATTERNS BEGINNING FALL - 1980
OFFICE OF INSTITUTIONAL RESEARCH

NATIVE AMERICAN STUDENTS WHO ENTERED EMC FALL 1980 (STATUS 1,2,4, or 7)

NAME	SEX	E	MAJ	ENTR	F 80	W 81	W 81	X 81	F 81	W 82	S 82	X 82	F 82	W 83	S 83	X 83	F 83	W 84	S 84	X 84	F 84	W 85	S 85	X 85	F 85	W 86	S 86	X 86	F 86	W 87	S 87	X 87
516908992	F	1	990	F80	16	15	15		13	11	09	--	--	--	--	--	16	14	12	--	12	12	12	--	12	12	14	--	18	18	18	--
516929826	F	1	990	F80	12	12	12		16	16	16	13	18	18	18	--	--	--	--	--	16	17	18	--	16	14	16	16	18	18	15	18
517925350	F	1	100	F80	15	17	14		15	16	18	--	16	16	16	--	14	13	12	--	--	--	--	--	--	--	--	--	16	16	16	16
517743476	F	1	770	F80	14	14	16		15	15	16	--	16	15	17	14	16	15	18	--	16	16	14	--	17	16	16	16	--	--	--	--
554082210	M	1	990	F80	16	12	14		18	18	16	--	18	18	16	--	18	17	14	--	18	16	--	--	--	--	--	--	18	18	18	--
517526513	F	1	690	F80	15	12	12		17	17	17	17	18	18	18	14	--	--	--	--	--	--	--	--	18	18	18	12	18	18	18	12
516644775	F	1	809	F80	17	17	13		14	14	14	--	14	14	14	--	14	14	14	--	16	15	12	--	14	12	12	--	18	16	16	16
502547362	F	1	230	F80	13	15	12																									
516844524	F	1	802	F80	13	13	10		06	--	--	--	--	--	--	--	--	--	--	--	16	16	16	16	16	17	16	--	18	16	18	14

Figure 3: Persistence Report

EASTERN MONTANA COLLEGE
STUDENT PERSISTENCE PATTERNS SUMMARY
OFFICE OF INSTITUTIONAL RESEARCH

12/29/81

PERSISTENCE SUMMARY
FOR F80 FIRST-TIME
FRESHMEN

FIRST-TIME FRESHMEN:		OTHER FRESHMEN:		SOPHOMORES:		JUNIORS:	SENIORS:		TOTALS:	
F80	868	F80		F80		F80	F80		F80	868
W81	6	W81	621	W81	1	W81	W81		W81	628
S81		S81	521	S81	4	S81	S81		S81	526
X81		X81	17	X81	29	X81	X81	1	X81	47
F81		F 81	256	F81	124	F81	F81	1	F81	514

Figure 4: Persistence Summary

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